CHAPTER 1: ELECTRICITY SUPPLY AND DEMAND IN MONTANA

Electricity is the new energy crisis. During 2000 and 2001, price spikes and supply disruptions spread across the country, most notably in the West. Even before that, the electricity industry had begun sweeping changes, prompted by the deregulation of the wholesale electricity markets in 1992 through the federal Energy Policy Act and deregulation of the Montana retail market in 1997 by SB390. This chapter provides historical supply and demand information needed to put the current changes in context, along with some estimates of future consumption. Because of these changes, the historical data, while still useful, are not as reliable predictors of the future as they once were.

Transmission, which affects access to out-of-state markets by Montana suppliers and consumers, is covered in a separate chapter. Prospects for future supplies and their effect on rates, as well as energy efficiency and how it could be encouraged, will be covered in a supplement in November 2002, after the market digests the recent PSC decision. The supplement will address both conventional sources (primarily natural gas and coal) and "new" technologies (primarily wind and distributed generation of various types). Still, growth in the Montana in-state market will not, by itself, justify much new generation construction over the coming decade.

1. Necessary Definitions

Certain terms are used throughout this chapter and are explained here. Electricity is measured in kilowatt-hours (kWh) or megawatt-hours (MWh). A MWh is 1,000 kWh. One MWh is produced when a 1 MW generator runs for one hour. A 1 MW generator running for all the 8,760 hours in a year produces 1 average Megawatt (aMW). As one illustration of electricity use, residential customers without electric heat use typically use 10-30 kWh per day. As another, the Helena and the Helena valley use around 80 aMW (700 million kWh), with a peak around 140 MW (Data request MCC-8, PSC Docket No. D2001.10.144).

Montana Power Company (MPC) sold most of its generating units to PPL Montana at the end of 1999. The remainder of the units and the entire distribution utility were sold to NorthWestern Energy (NWE) in February 2002. Some data from the period of MPC ownership are labeled PPL Montana or NWE where that would be more useful for the reader understanding the current situation.

2. Montana in Perspective

Montana generates more electricity than it consumes. Even so, it is a small player in the western electricity market. Montana generating plants have the capacity to produce 5,200 MW of electricity. Primarily because hydro generators depend on the rise and fall of river flows, but also because any plant needs downtime for refurbishing and repairs, Montana produced an annual average of 3,200 aMW, 1995-1999. During that time, Montana sales and transmission losses accounted for slightly more than half of production, or, in the year 2000, about 1,800 aMW.

Key Electricity Facts for Montana

Generation capacity	-	5,200 MW
Average generation	-	3,200 aMW
Load in 2000	-	1,800 aMW

Montana straddles the two major electric interconnections in the country. Most of Montana is in the Western interconnection, which covers all or most of 11 states, two provinces and a bit of northern Mexico. Only about 5 percent of Montana's load is in the Eastern interconnection, along with less than 1 percent of the electricity generated. The 1999 Montana load (sales plus transmission losses) was equivalent to about 2 percent of 86,122 aMW load in the Western interconnection. Montana generation accounted for less than 4 percent of total West generation that year. As another comparison, 1999 sales in Montana were equivalent to about 6 percent of the 26,807 aMW sold in California.

3. Generation

There are 45 generating facilities in Montana (Table E1). The oldest are Milltown Dam, near Missoula, and Madison Dam, near Ennis; both were built in 1906. The largest are the four privately owned coal-fired plants at Colstrip, which have a combined capability of 2,094 MW. (Capability is the maximum amount of power a plant can be counted on to deliver to the grid, net of in-plant use.) The largest hydroelectric plant is U.S. Corps of Engineers' Libby Dam with 600 MW. The smallest plants supplying the grid in Montana are a micro-hydro plant at 60 kW and a wind turbine at 65 kW.

Average Generation by Company, 1995-1999

Company	aMW	Percent
PPL Montana[1,2]	940	29.6%
Puget Sound Power & Light[2]	509	16.0
Avista (WPP)[2]	403	12.7
Bonneville Power Administration[3]	382	12.0
Western Area Power Administration[3]	323	10.2
Portland General Electric[2]	223	7.0
NorthWestern Energy[2,4]	169	5.3
PacificCorp[2]	114	3.6
Yellowstone Energy Partnership	47	1.5
Other	69	2.2
TOTAL	3177	100.0%

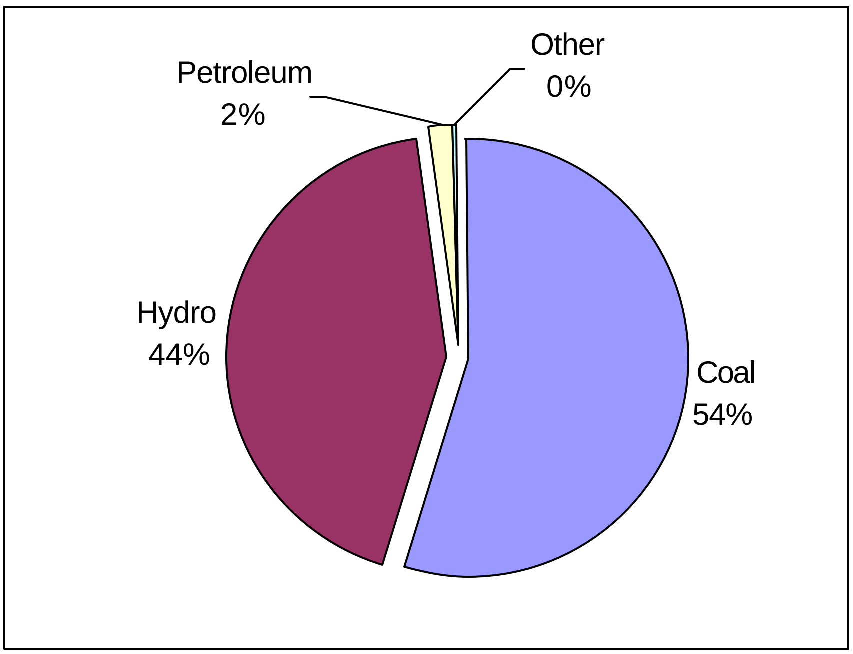
[1] PPL Montana plants were owned by MPC until mid-December, 1999.
[2] Public data on output for Colstrip 1-4 are reported for the entire facility, not individual units. In this table, the output was allocated among the partners on the basis of their ownership percentages.
[3] Distributes power generated at U.S. Corps of Engineers and U.S. Bureau of Reclamation dams.
[4] NorthWestern Energy plants were owned by MPC until February 2002.

The only sizeable plants coming on line in the 1990's were two built to take advantage of the federal Public Utility Regulatory Policies Act of 1978. PURPA established criteria under which, prior to deregulation of the wholesale electricity markets, non-utility generators (or qualifying facilities—QFs) could sell power to utilities. The Montana One waste-coal plant (41.5 MW) was built near Colstrip in 1990 and the BGI petroleum coke-fired plant (65 MW) was built in Billings in 1995. These two now account for about 92 percent of the average production of all QFs in Montana.

Montana Power Company plants, now owned by PPL Montana, produced the largest amount of electricity on average in 1995-1999 (see previous page; also Table E2). PPL Montana's facilities accounted for about 30 percent of the total generation in Montana. Federal agencies—Bonneville Power Administration and Western Area Power Administration—collectively produced 22 percent of the electricity generated in Montana. The MPC plants not bought by PPL—Milltown Dam and a share of Colstrip 4—now belong to NorthWestern Energy.

Montana generation is powered almost entirely by coal (54 percent) and hydro (44 percent) (1995-1999 average, Table E3; see Figure E1). Over the last 15 years, about 25 percent of Montana coal production has gone to generate electricity in Montana. Until 1985, hydro was the dominant source of net electric generation in Montana (Table E5). The small amount of petroleum used actually is petroleum coke from the refineries in Billings. Very small amounts of natural gas and wind round out the picture.

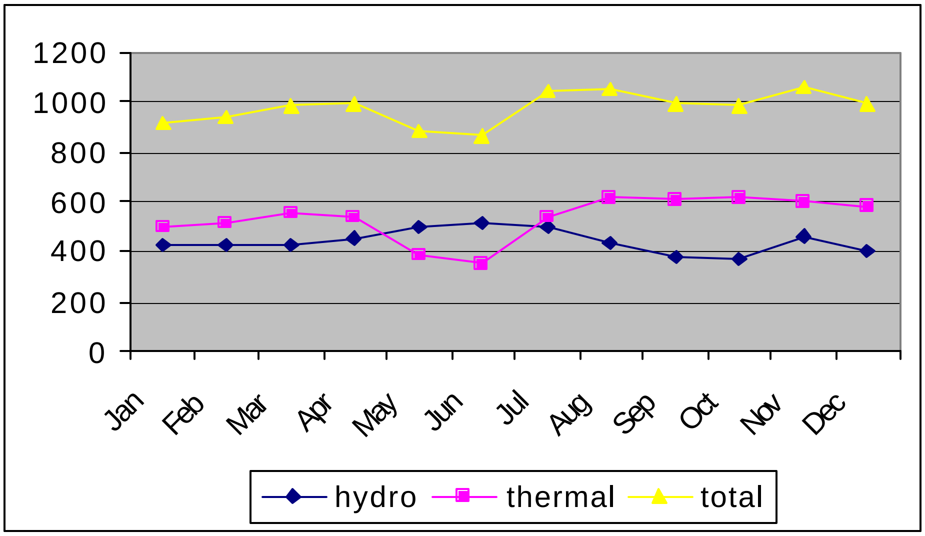
Figure E1. Generation by fuel



Source: Table E3.

During spring runoff, utilities operate their systems to take advantage of cheap hydropower, both on their systems and on the non-firm market around the region. Routine maintenance on thermal plants is scheduled during this period. Thermal plants generally must be run more in the fall when hydro is low. This pattern is apparent in the graph of operations on Montana Power's system during 1997 through 1999 (see Figure E2).

Figure E2. Average output of Montana power plants, 1997-1999 (aMW)

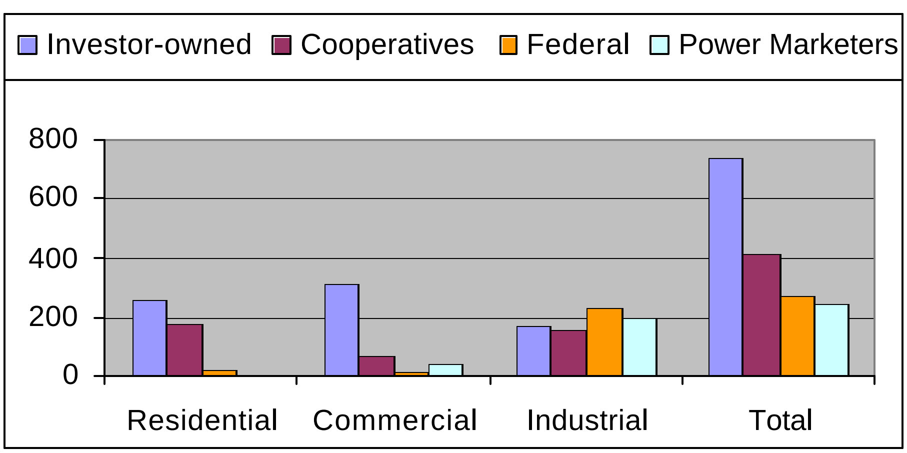


Source: U.S. DOE, Energy Information Administration, Forms 759 and 860 databases.

4. Consumption

Montanans are served by 38 distribution utilities: 4 investor-owned, 30 rural electric cooperatives, 3 federal agencies and 1 municipal (Table E9; Maps). (Four of the co-ops only serve a handful of Montanans.) Two-thirds of these utilities operate mostly or exclusively in Montana. Some of the distribution utilities also provide power from power marketers, primarily to industrial customers (Table E8). In 2000, investor-owned utilities made 45 percent of the electricity sales in Montana, co-ops 25 percent, federal agencies 16 percent and power marketers 14 percent (Table E8; see Figure E3).

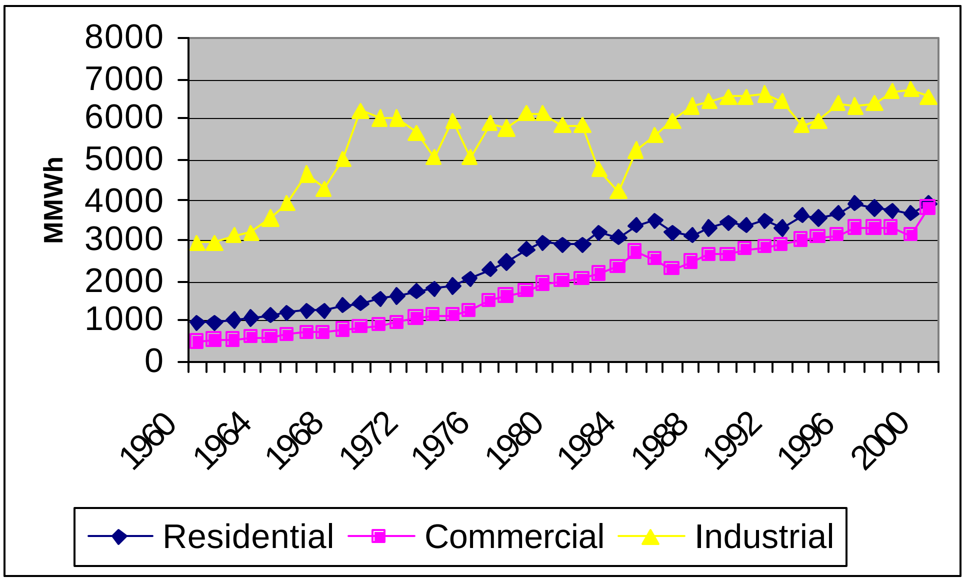
Figure E3. Distribution of 2000 sales by type of utility (aMW)



Source: Table E8.

Sales in 2000 were 14.5 billion kWh. The residential and commercial sectors accounted for about a quarter each of total sales, and industrial, a little less than half. Sales have tripled since 1960 (Table E6; see Figure E4). Growth was faster in the first half of that period than in the latter. Since 1990, sales to the commercial sector have grown the most, followed by the residential sector. Industrial sales have bounced around, but on the whole haven't increased much. The impact of the 2000-2001 price spike doesn't appear in these data, but it did significantly and permanently reduce industrial consumption. Future consumption patterns will be noticeably different than those of the past decade.

Figure E4. Annual sales in Montana



Percentage of sales, 2000

Residential - 27 %
Commercial - 26
Industrial - 45
Other - 2
Total -100 %

Source: Table E6.

The cost of electricity didn't change much during the 1990s (Table E7). Throughout that decade, as in previous decades, electricity in Montana cost less than the national average. In 2000, Montana averaged 4.74 cents/kWh vs. 6.78 cents/kWh nationally. The average price per kWh for residential customers was 6.5 cents in 2000, up from 5.4 cents in 1990 (Table E8). The average price per kWh for commercial customers was 5.7 cents in 2000, up from 4.7 cents in 1990. Complete cost on industrials are not available, due to deregulation; however, the average cost for industrial customers served by private utilities was 4.0 cents/kWh in 2000, up from 3.3 cents in 1990. On average, the rates of cooperatives and private utilities were about the same in 2000; however, that average masks considerable variation.

Montana residential consumption averaged 810 kWh/month in 2000, about 1.1 akW (Table E8). This average covers a wide range of usage patterns. Households without electric heat can run 200 kWh to 1,000 kWh per month (0.3-1.4 akW), depending on size of housing unit and amount of appliances. Electrically heated houses easily could range between 1,800 kWh to 3,000 kWh per month (2.5 and 4.0 akW). Extreme cases could run higher or lower than these ranges.

Commercial accounts averaged 4,200 kWh/month or 50 akW per year. Because so many different types of buildings and operations are included in the commercial sector, it's difficult to describe a typical use pattern.

Variability in the load and pattern of use are even greater in the industrial sector. The largest industrial customers are shown in the following table. These figures date before the price spikes in 2000 and 2001 forced some companies to cut consumption or to shut down.

Large Industrial Electrical Use (aMW)

ASARCO	8.7	Holnam	5.0
ASiMI	~75	Louisiana Pacific	7.0
Ash Grove Cement	4.6	Montana Refining	3.4
Cenex	18	Montana Resources	43.0
CFAC	342	Montana Tunnels	9.5
Conoco Pipeline	20.0	Plum Creek	33
Conoco Refinery	27.0	Smurfit-Stone	52.0
ExxonMobil	27.0	Stillwater Mining	20.0
Golden Sunlight	10.0	Stimson	6.2

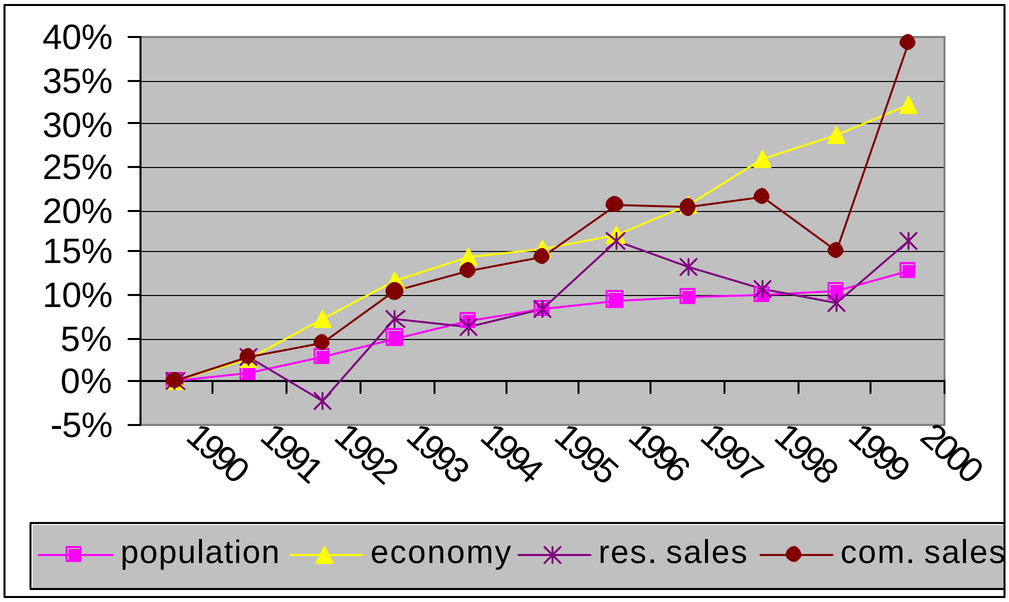
Data initially provided from best available sources by Don Quander, Large Customer Group; compiled by EQC and DEQ. Holnam late last year changed its name to Holcim.

5. Past and Future Changes in Electricity Consumption

During the 1990-2000 decade, residential consumption rose at an average annual rate of 1.5 percent, commercial at 3.4 percent and the overall growth rate was 1.0 percent statewide. Residential growth tracked population growth, while commercial growth tended to track economic activity, as measured by the gross state product (see Figure E5). Even though houses are getting larger, the number of second homes growing and the proliferation of consumer electronics continuing, per capita use of electricity is not climbing significantly in Montana. As for growth in commercial sales, one can expect that to continue slow with the slower economy.

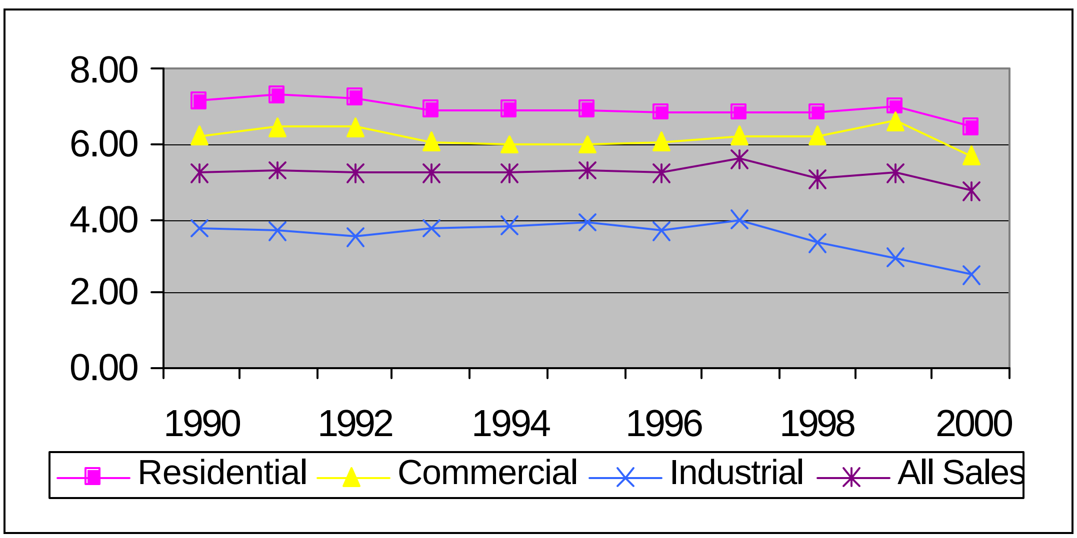
As electricity prices go up, growth in consumption should slow. In the last decade, Montanans saw little change in the price of electricity in real terms (as adjusted by the consumer price index; see Figure E6), with prices actually declining toward the end of the decade. In spite of all the news stories about rising rates due to the energy crisis of 2000-2001, only about one-quarter of the Montana load had been exposed to market prices by the start of 2002. The entire impact of increased prices on consumption has yet to hit.

Figure E5. Amount of growth in residential and commercial electricity sales, population, economic activity in the 1990's



Note: The swings in 1999 and 2000 commercial sales may reflect data problems due to deregulation.
Source: U.S. Department of Commerce, U.S. Census, Population Estimates Program and Bureau of Economic Analysis, Regional Accounts data (real dollars); Table E6.

Figure E6. Cost per kWh, 1990-2000 (2000 cents)



Source: Table E7.

The increased prices due to deregulation and the California price spikes hit the customers of Flathead Electric Cooperative and "choice" customers served by MPC (now NWE) distribution lines. MPC customers who had moved to choosing their own power supplier included most of the large industrial load, some commercial customers and a few residential customers. Flathead residential and small commercial customers have seen their rates jump from a base fee of $15 per month and $0.0392/kWh at the start of 2000 to $16 and $0.0622 in October 2001. That is a 53 percent increase in the cost of electricity (assuming an average consumption of 800 kWh per month). Energy costs paid by choice customers served by the Montana Power (now Northwestern Energy) distribution system aren't published, though rates are known to have dropped back down. However, typical bills for Northwestern Energy's default customers, who consume about 40 percent of the electricity sold in Montana, went up July 1 by 10 percent for residential customers and 18 percent for most commercial customers; other customer classes also saw rate increases of varying amounts.

In addition, another large portion of Montana's electricity use was exposed to market prices, albeit in a fashion different from Flathead customers and MPC choice customers. Bonneville Power Administration (BPA) bought back the contracted deliveries it had promised Columbia Falls Aluminum Company (CFAC) and the other aluminum plants in the Pacific Northwest. This buyback offer, which was accepted by all the aluminum smelters, provided BPA with needed power at a lower cost than it could purchase on the open market. For CFAC, reselling the power gave a better profit than could be obtained by smelting aluminum. The shutdown, which reduced Montana consumption by about 340 aMW, lasted over a year with the first potlines reopening in January 2002.

There are no statewide forecasts for future electricity consumption. The rising prices of electricity combined with an economy that has slowed since the early 1990's suggest the growth in electricity consumption will be slower this decade than the last. Improved efficiency also could reduce loads significantly (see Section 6). Finally, if the trend over the last few decades towards warmer winters continues, as reported by the Climate Prediction Center, National Weather Service (http://www.cpc.ncep.noaa.gov/charts.htm), Montana's electricity use will decline further.

In the absence of forecasts, only scenarios of future growth can provide a sense of the range of future consumption. First, one could assume that the 1990's pattern would continue, with residential and commercial sectors continuing to grow at a combined average rate of 2.4 percent per year and industrial load not dropping. Second, one could assume, as MPC did in its Tier II filing before the Public Service Commission, that non-industrial loads would grow at 1 percent per year and certain industrial loads (ASARCO, MRI and Golden Sunlight) would be lost and not replaced. Finally, as a worst case one could assume MPC's Tier II scenario, plus that the yearlong shutdown of CFAC reoccurs and becomes permanent. These scenarios produce a range of possibilities, from an optimistic 260 aMW increase to an extremely pessimistic loss of 336 aMW.

Possible Increases in Statewide Load by 2010

Scenarios	aMW
The 1990's continue:	260
MPC's Tier II:	33
Tier II minus CFAC:	-336

While these are only scenarios, and not predictions, the range does suggest minimal need for net additions of generation resources to serve increases in Montana loads. To be economically viable, any substantial addition to generation resources in Montana will need to sell to out-of-state markets or to displace existing in-state resources. Therefore, any new generation would need 1) to offer the price and have the transmission access to compete in out-of-state markets; 2) to offer a better package of prices and conditions than those resources currently supplying Montana loads; or 3) to be conceded a Montana market by existing resources choosing to take higher profits by selling out of state.

6. Potential for Efficiency Improvements

Cost-effective energy efficiency improvements plausibly could meet much or all of the net increase in statewide load over the next decade. There are no comprehensive estimates of the potential for efficiency improvements. However, analyses that have been done and the load reductions seen during the electricity crisis in 2000 and 2001 suggest that significant potential exists. Better estimates of the potential in Montana might come from the Northwest Power Planning Council's Fifth Regional Plan. DEQ is assisting Council staff with the efficiency estimates and may be able to report on those estimates in the November supplement to this chapter.

Efficiency improvements reduce both cost and risk. First, they can reduce the total cost of energy services. For customers, they reduce the monthly bill. For providers, they postpone or eliminate the need to acquire more expensive resources. Second, efficiency improvements reduce exposure to electricity price volatility. By reducing the need for electricity, especially peak-hour electricity, such improvements provide a hedge against the impacts of expensive upswings in price.

The amount of energy efficiency improvements worth pursuing depends on the future price of electricity. The lower or the less volatile expected future prices, the less attractive energy efficiency investments are. The higher or more volatile expected future prices, the more attractive such investments are. Just like any other energy resource, there is a range of energy efficiency, rather a fixed amount, waiting to be developed.

There are no statewide estimates of the potential energy efficiency improvements, either in total or by sector. While some of the easiest and least difficult to obtain are in large commercial and industrial operations, potential efficiency improvements can be found in all sectors. Based on studies around the country, as well as some in-state estimates, it has been reasonable to assume potential reductions are in a range around 10 percent. Given how perceptions of the electricity industry have changed over the last two years, that range may be low.

One of the most cited estimates for Montana is that offered by NorthWestern Energy in the default supply portfolio docket (data request PSC-22—amended, D2001.10.144). NWE estimated the potential for cost-effective efficiency improvements for customers served by their distribution lines, who consume about two-thirds of the non-aluminum plant load in Montana. The estimates were extrapolations from the more detailed analysis done in MPC's 1995 Integrated Least Cost Resource Plan. NWE estimated an achievable reduction of 98 MW in load and 87 aMW reduction in energy, using measures with a levelized cost of no more than

$0.035/kWh. The average cost of all measures was $0.023/kWh. For default customers alone, the totals were 76 MW and 62 aMW, or about 7 percent of current load and 9 percent of sales. These estimates do not include any premium amounts the utility—or the customer—might be willing to purchase as protection against future price volatility.

The reductions estimated by NWE and others can't be compared to the recent reductions observed in the Pacific Northwest and in California. The extensive load reductions in 2001 were short-term responses to a crisis situation. However, the crisis did give an indication of the amount of flex in electricity use and suggests the magnitude of changes in use that are possible. Those changes are far larger than had been expected previously.

The Readiness Steering Committee of the Pacific Northwest region studied the impact of various actions to reduce energy use in the region during the electricity crisis of 2000-2001. (The committee is an ad hoc group of utility industry, large customer and public agency representatives that advise the Northwest Power Pool and the region on electricity shortages.) The committee, in an October 2001 special report, estimated that the total impact of all electricity demand actions was a reduction by summer of 2001 of about 4,000 megawatts, almost 20 percent of what loads would have been under normal conditions. These actions included utility initiated programs, general appeals to the public and the response of consumers to price increases.

The largest portion of the response came from curtailing industrial production. By July 2001 the electricity demand of aluminum smelters was almost completely gone, a reduction of more than 2,500 megawatts; operators found it more profitable to resell their contracted supplies than to produce aluminum. Irrigation customers also reduced their use by an average of 300 megawatts over the May-September irrigation season, in exchange for payment from their suppliers. About 500 megawatts of reduction came from industrial customers who faced high market prices. Not all of this reduced use was due to cutbacks in operations; a portion came from customers beginning to generate some of their own electricity. Another 160 megawatts came from customers in other sectors who accepted payment from their electricity suppliers to reduce their consumption by cutting back operations. Demand response to higher electricity rates charged by some utilities was estimated at about 150 megawatts by July. Finally, while customers of most utilities were insulated from the high prices in the wholesale market, expanded conservation education programs, along with the media coverage of the California shortages, were believed to have caused some reduction in regional loads, though this couldn't be quantified.

The load reductions seen by the summer of 2001 would not be cost-effective or advisable under normal conditions. What they do show is the ability of consumers to change their usage in the face of higher prices, either in terms of what they pay or what they're offered to forego using electricity. As prices for electricity climb, some improvement in the economy's energy efficiency can be expected in any event, though not to the extent that could come from a more formal program of resource acquisition. Difficulties in obtaining information and financing always will deter some individual consumers from otherwise cost-effective investments.